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(54) **METHOD AND APPARATUS FOR VIRTUAL CABLE TEST USING ECHO CANCELLER COEFFICIENTS**

(71) Applicant: **MARVELL INTERNATIONAL LTD.**, Hamilton (BM)

(72) Inventors: **Junqing Sun**, Fremont, CA (US); **Danjin Wu**, Sunnyvale, CA (US); **Xiong Fang**, Palo Alto, CA (US); **Baohua Chen**, Fremont, CA (US); **William Lo**, Cupertino, CA (US)

(73) Assignee: **MARVELL INTERNATIONAL LTD.** (BM)

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(60) Provisional application No. 61/263,669, filed on Nov. 23, 2009.

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G01R 31/11 (2006.01)
H04L 12/26 (2006.01)
G01R 27/06 (2006.01)

(52) **U.S. Cl.**
CPC ***H04B 17/00*** (2013.01); ***G01R 31/11*** (2013.01); ***H04L 12/2697*** (2013.01); *G01R 27/06* (2013.01); *H04L 43/50* (2013.01)

(58) **Field of Classification Search**
CPC H04B 17/00; H04L 12/2697; H04L 43/50; G01R 31/11; G01R 27/06
See application file for complete search history.

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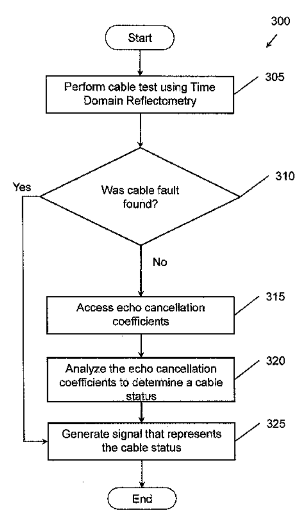
Primary Examiner — Min Jung

(57) **ABSTRACT**

Systems, methods, and other embodiments associated with echo cancellation are described. According to one embodiment, an apparatus includes a cable tester that determines whether a fault in a cable exists by using echo cancellation values.

20 Claims, 5 Drawing Sheets



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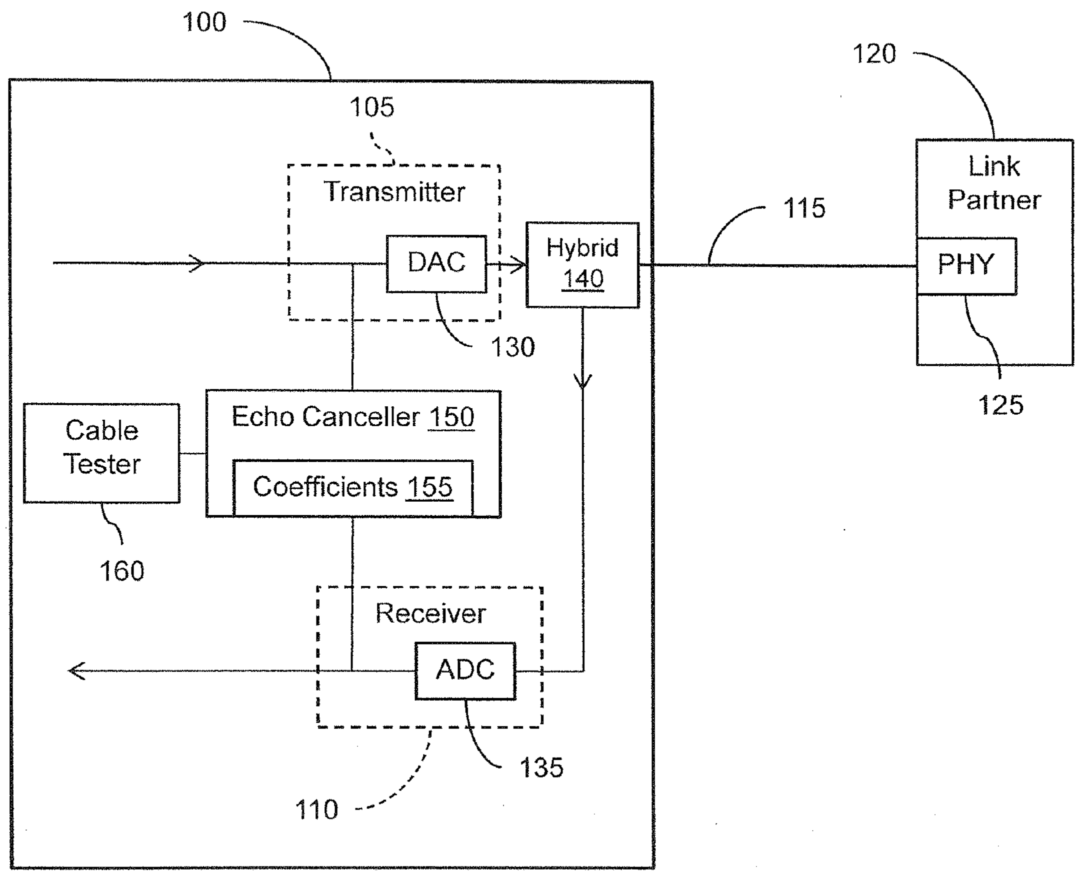
100
105
Transmitter
DAC
Hybrid
140
115
120
Link
Partner
PHY
125
130
Cable
Tester
Echo Canceller 150
Coefficients 155
160
Receiver
ADC
135
110

Figure 1

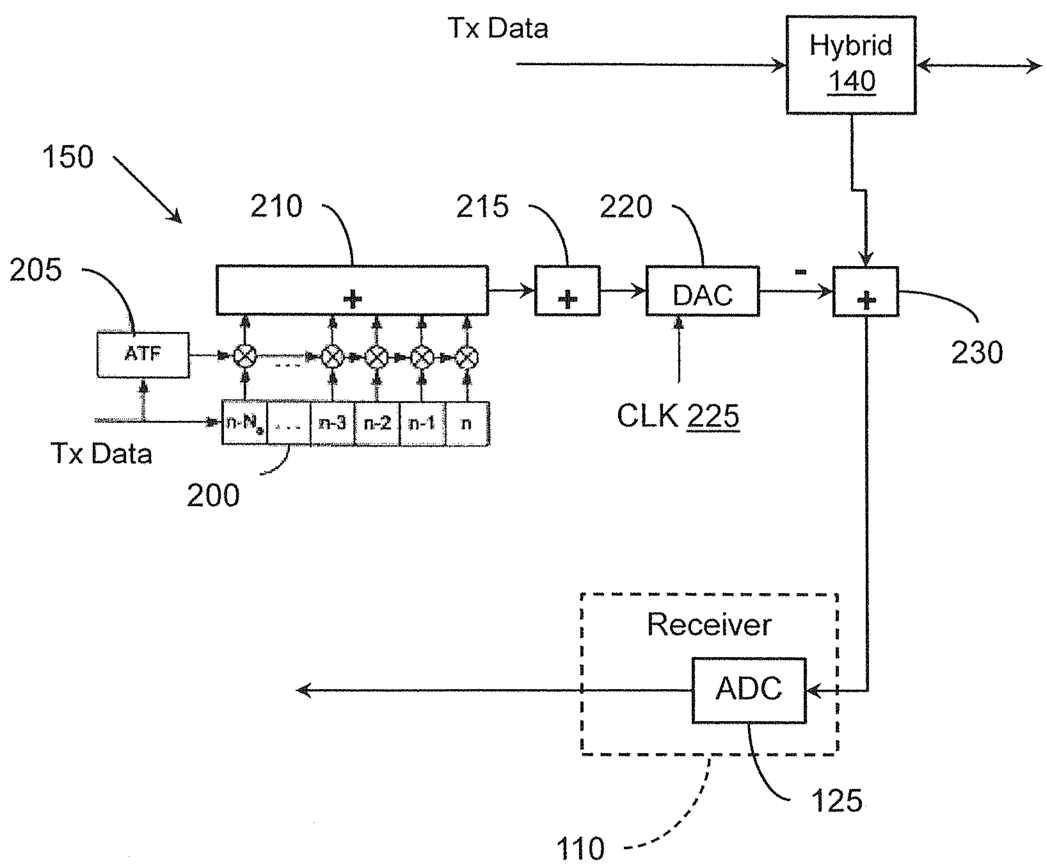
Tx Data
Hybrid
140
150
210
215
220
205
+
+
DAC
-
+
ATF
230
n-N
...
n-3
n-2
n-1
n
CLK 225
Tx Data
200
Receiver
ADC
125
110

Figure 2

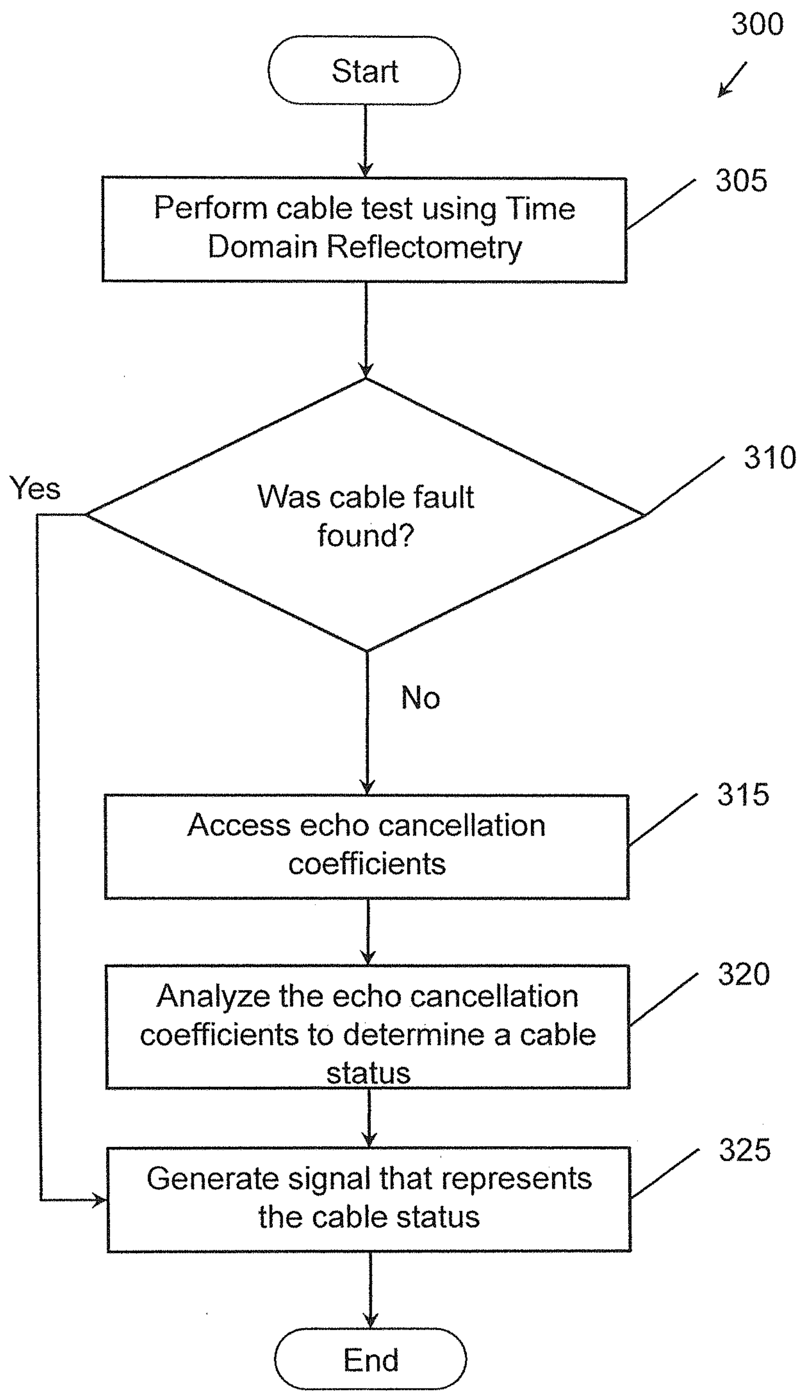
300
Start
Perform cable test using Time Domain Reflectometry
305
Was cable fault found?
310
Yes
No
Access echo cancellation coefficients
315
Analyze the echo cancellation coefficients to determine a cable status
320
Generate signal that represents the cable status
325
End

Figure 3

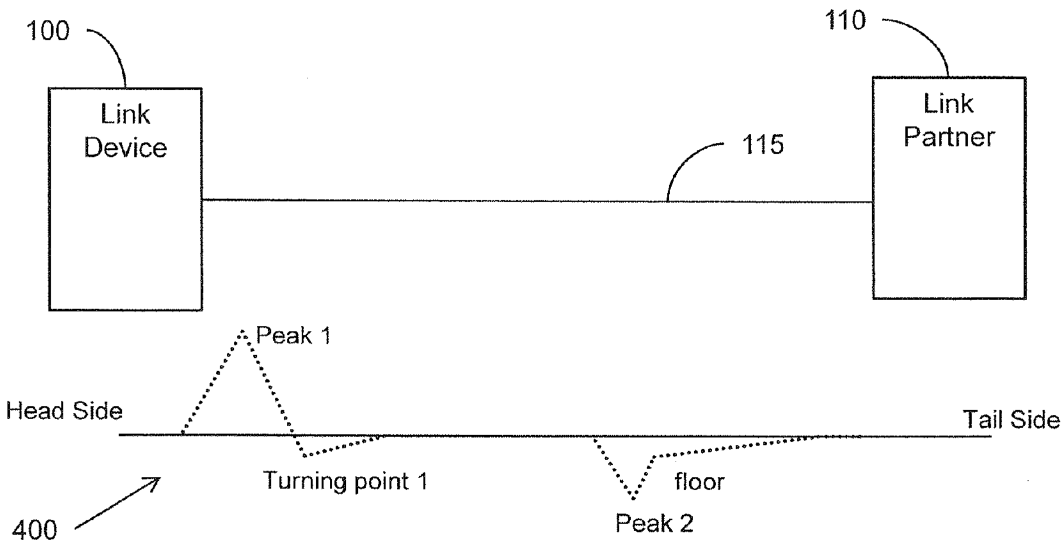
100
110
Link
Device
Link
Partner
115
Peak 1
Head Side
Tail Side
Turning point 1
floor
Peak 2
400

Figure 4

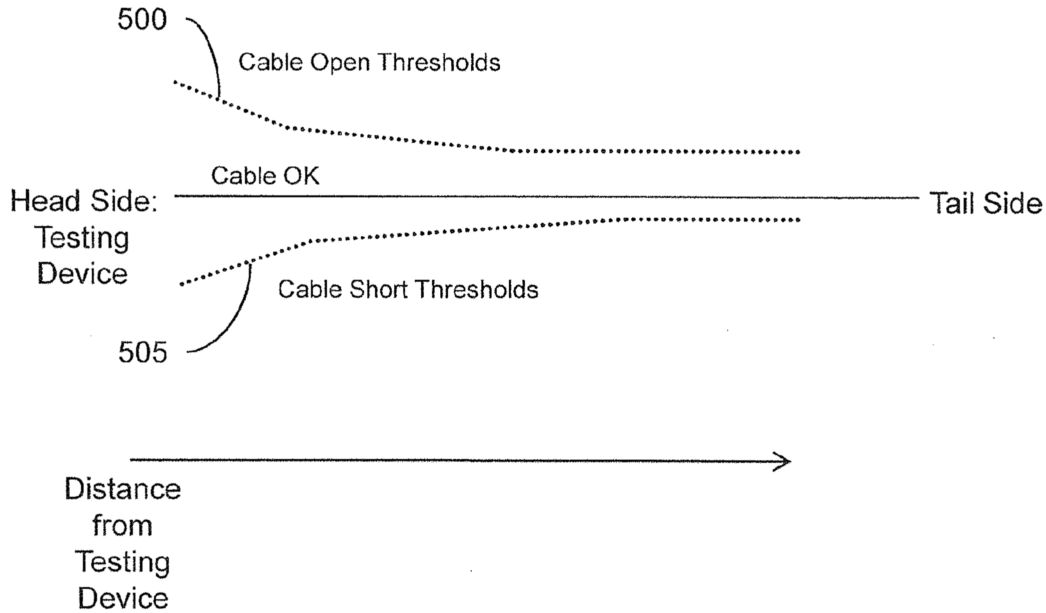
500
Cable Open Thresholds
Cable OK
Head Side: Testing Device
Tail Side
Cable Short Thresholds
505
Distance from Testing Device

Figure 5

METHOD AND APPARATUS FOR VIRTUAL CABLE TEST USING ECHO CANCELLER COEFFICIENTS

CROSS REFERENCE TO RELATED APPLICATIONS

This patent disclosure is a continuation of U.S. application Ser. No. 12/917,748 filed on Nov. 2, 2010, now U.S. Pat. No. 8,582,443 which claims benefit under 35 USC §119(e) to U.S. Provisional Application No. 61/263,669 filed on Nov. 23, 2009, which are both hereby wholly incorporated by reference.

BACKGROUND

Cable testers are typically used to detect problems in a cable (e.g., a Category 5 cable and so on). For example, a cable tester can perform an analysis of a cable to detect a short, an open, a crossed pair, or a reversed pair within the cable. A short condition occurs when two or more wires within a cable are short-circuited together. An open condition occurs when there is a lack of continuity between ends at both ends of a cable. A crossed pair occurs when a pair of wires within a cable communicates with different pins at each end of the cable. A cable tester can also be used to determine a length of a cable. A cable tester can be coupled to one end of a cable through a first connector (such as an RJ-45 or other connector), and a second end of the cable can be connected to a load through a second connector. Conventional cable testers typically require the load to be a remote node terminator or a loop back module, as conventional cable testers may generate inaccurate results when a cable is terminated by an active link partner that is generating link pulses during a test.

Cable testers can employ time domain reflection (TDR), which is a measurement technique used to determine the characteristics of electrical lines by observing reflected waveforms. The amplitude of the reflected signal can be determined from the impedance of a discontinuity. For example, a cable tester can transmit a test pulse on a cable and measure an elapsed time until a reflection from the cable is received. Using the elapsed time and a cable propagation constant, a distance to a fault within the cable can be estimated. During a cable test, two waves can propagate through a cable—a forward wave that propagates from a transmitter in the cable tester towards the load or fault, and a return wave (or reflection) that propagates from the load or fault to the cable tester.

A perfectly terminated line has no attenuation and an impedance that is matched to a source impedance—i.e., the load is equal to the line impedance. The return wave is zero for a perfectly terminated line because the load receives all of the forward wave energy. For open circuits, the return wave has an amplitude that is approximately equal to the forward wave. For short circuits, the return wave has a negative amplitude that is also approximately equal to the forward wave.

Ethernet network devices such as switches, routers, and network appliances typically include physical layer devices with ports that connect to a cable. Cable tester technology that is implemented with a physical layer device (PHY) of an Ethernet network device allows the PHY to check a quality of a cable connection without the need to unplug the cable, insert a cable tester, and loop back the far ends of the cable.

SUMMARY

In one embodiment an apparatus includes a transmitter configured to transmit signals to a cable and a receiver configured to receive signals from the cable. An echo canceller is connected to the transmitter and the receiver, wherein the echo canceller includes echo coefficients configured to reduce echo signals from the signals received by the receiver. A cable tester is configured to analyze the echo coefficients from the echo canceller to determine at least a tail end peak that is a peak at a distance along the cable; wherein the cable tester is configured to determine a status of the cable by comparing an amplitude of the tail end peak to a threshold.

In another embodiment, a method includes accessing echo cancellation coefficients from a memory; analyzing the echo cancellation coefficients to determine a status of a cable operatively connected to a communication device, wherein the analyzing includes determining at least a tail end peak that is a peak at a distance along the cable; determining an amplitude of the tail end peak and comparing the amplitude to a threshold, wherein the status of the cable is determined based at least in part on the comparison; and generating a signal that represents the status of the cable.

In another embodiment, an apparatus comprises a transmitter for transmitting signals to a cable and a receiver for receiving signals from the cable. An echo cancellation circuit is configured to determine echo cancellation coefficients that model an impulse response of interference signals received by the receiver from the cable. A cable tester is configured to determine a fault in the cable based on the echo cancellation coefficients of the echo cancellation circuit. A time domain reflectometry (TDR) cable tester is configured to transmit a test pulse though the cable and determine a status of the cable from received reflected signals based on at least time domain reflectometry; and wherein the apparatus is configured to perform a first cable test using the TDR cable tester to determine the status of the cable, and if a fault in the cable is not found, then perform a second cable test by analyzing the echo cancellation coefficients with the cable tester to determine the status of the cable.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate various systems, methods, and other embodiments of the disclosure. It will be appreciated that the illustrated element boundaries (e.g., boxes, groups of boxes, or other shapes) in the figures represent one example of the boundaries. It will be appreciated that in some examples one element may be designed as multiple elements or that multiple elements may be designed as one element. In some examples, an element shown as an internal component of another element may be implemented as an external component and vice versa. Furthermore, elements may not be drawn to scale.

FIG. **1** illustrates one embodiment of an apparatus that includes a cable tester.

FIG. **2** illustrates one embodiment of an echo canceller.

FIG. **3** illustrates one embodiment of a method for testing for cable faults using two techniques.

FIG. **4** illustrates one example of a shape of echo cancellation coefficients.

FIG. **5** illustrates one embodiment of cable thresholds to detect a fault.

DETAILED DESCRIPTION

Described herein are example systems, methods, and other embodiments associated with testing for cable faults. In one embodiment, a physical layer device is configured to detect a fault in the cable by analyzing echo cancellation coefficients.

With reference to FIG. **1**, one embodiment of an apparatus **100** is shown that is configured to detect faults in a cable (also referred to herein as "cable faults"). The apparatus **100** may be a physical layer device (e.g., Ethernet PHY), a digital signal processor (DSP), a transceiver, a network communication device, and so on. The apparatus **100** includes a transmitter **105** and a receiver **110** that are configured for connection to a cable **115** via a port. Communication lines through the transmitter **105** and the receiver **110** define a transmission path and a receiving path, respectively. The cable **115** can be used to connect the apparatus **100** to a remote device (link partner **115**) that includes a PHY **125**. The transmitter **105** includes a digital-to-analog converter (DAC) **130** for converting outgoing transmission signals to analog form. The receiver **110** includes an analog-to-digital converter (ADC) **135** for converting incoming analog signals to digital form.

In one embodiment, the apparatus **100** is implemented on a chip including one or more integrated circuits or other logic components configured to perform one or more of the functions described herein. The apparatus **100** may be implemented in an electronic device (e.g., computer, laptop, printer, hand held device, and so on) that can be connected to a cable and be able to communicate with a link partner.

In one embodiment, the transmitter **105** and receiver **110** are connected to a hybrid circuit **140**. The hybrid circuit **140** controls access to the communication channel (e.g., cable **115** with four twisted pair wires) for full-duplex bi-directional operation over the twisted pair cable.

To compensate for echo signals that may appear in the apparatus **100**, the apparatus **100** includes an echo canceller **150** connected to the transmitter **105** and the receiver **110**. In one embodiment, the echo canceller **150** includes echo coefficients **155** that are used to cancel or at least reduce echo signals. This will be described in more detail below. In one embodiment, the plurality of echo coefficients **155** are maintained in a finite impulse response (FIR) filter with a plurality of taps. In some embodiments, the echo coefficients **155** may be implemented in one or more shift registers, a look-up table, or other storage/memory device.

The apparatus **100** also includes a cable tester **160** connected to the echo canceller **150**. The cable tester **160** is configured to determine/detect a cable fault in the cable **115** using the echo coefficients **155** from the echo canceller **150**. By using the echo cancellation coefficients **155**, a separate test pulse does not need to be transmitted over the cable and thus the apparatus **100** can check the status of the cable without breaking or interrupting the communication link. As will be further described below, determining whether a cable fault exists based on the echo coefficients **155** may provide a more accurate or more sensitive detection mechanism for minor cable faults.

With reference to echo cancellation, a general description is as follows. As data is transmitted from the transmitter **105** through the cable **115**, discontinuities in the cable **115** may cause a signal to be reflected back (echo signal) to the apparatus **100**. The echo signals are then received by the receiver **110** along with actual data signals and may distort the data signals.

Echo cancellation involves recognizing the originally transmitted signal that re-appears, with some delay, in the transmitted or received signal. Once the echo is recognized, the echo can be removed by "subtracting" the echo from the transmitted or received signal. This technique is generally implemented using a digital signal processor (DSP), but in some embodiments can also be implemented in software, or both. Echo cancellation may be performed using echo suppressors, echo cancellers, or in some cases both. Initial echo cancellation coefficients **155** may be generated from observed tests that include transmitting known test patterns through a communication link and comparing received signals to the transmitted patterns. Certain differences between the transmitted signals and the received signals can be attributed to echo signals and corresponding cancellation coefficients are generated for cancelling out the echo signals. In some embodiments, an adaptive filter (FIR) may be used to modify the coefficients during operation of the apparatus **100** based at least in part on observed signal comparisons.

The apparatus **100** is not limited to any particular type or implementation of the echo canceller **150**. The apparatus **100** is not limited to the example echo canceller **150** discussed herein but can be implemented with other configurations, which include echo cancellation coefficients.

With reference to FIG. **2**, one embodiment of the echo canceller **150** is shown. For example, the echo canceller **150** includes a shift register **200**, an adaptive cancellation filter ATF **205**, and a combiner **210**. Shift register **200** receives transmission data symbols TxData. The shift register **200** can have a size (N_e) equal to a length of the echo canceller **150**. Adaptive cancellation filter **205** produces echo cancellation coefficients that model impulse responses of the echo interference signal encountered by the receiver **110**. A digital replica of the echo interference signal encountered by the receiver **110** is generated by multiplying the echo cancellation coefficients with data symbols TxData and summing the results through the combiner **210**. The adaptive cancellation filter **205** may be implemented as an adaptive transversal filter (ATF) using, for example, the least mean squares (LMS) algorithm. The digital replica of the echo interference signal can be sent to combiner **215** and to a digital-to-analog converter DAC **220**. The DAC **220** can be clocked with clock signal **225** to ensure that echo interference signals are properly cancelled out at subtracter **230** (applied to the received analog signals from the hybrid circuit **140**). Timing delays that may be associated with the generation of the digital replica of the echo interference signal may be compensated for by appropriate time domain manipulations of the digital replica interference signal.

As previously discussed, impedance mismatches along a cable cause signal reflections on cables. To cancel these reflections, echo canceller coefficients of corresponding locations along the cable are determined and adapted. The coefficient value associated with a particular location along the cable is determined by the severity of the impedance mismatch at that location. For example, the severity of the impedance mismatch is determined based on the amplitude of the echo signal received from the cable location. The coefficients are then stored in the shift register **200** where one coefficient is stored in one tap. The shift register **200** may have a desired number of taps (e.g., 96 or more) where each successive tap/coefficient is associated with the next location along the cable where an impedance mismatch was found.

With reference to FIG. **3** and FIG. **1**, in another embodiment, the apparatus **100** may include a Time Domain Reflectometry (TDR) cable tester (not shown) in addition to the cable tester **160**. FIG. **3** illustrates one embodiment of a method of testing for cable faults using both testing techniques. With this combination of testers, the cable tester **160** is used to enhance the accuracy of the TDR cable tester.

In one embodiment, at **305**, a cable test is first performed using the TDR cable tester along one or more of the cable twisted pairs. This includes transmitting a test pulse on the cable and receiving a reflection signal. Time domain reflectometry is then used to analyze the reflection signal. At **310**, the method determines if a cable fault is detected based on predetermined thresholds. The details of time domain reflectometry are outside the scope of the present disclosure and will not be described in detail.

At **315**, if a cable fault is not found, it may mean that no fault exists or a fault was too small to be detected by the TDR method. In this case, the cable tester **160** is then executed to find cable faults that were not (or could not be) found by the TDR technique. At **315**, the echo cancellation coefficients are accessed from the apparatus **100** (e.g., a digital signal processor). At **320**, the echo cancellation coefficients are analyzed to determine a cable status of the cable operatively connected to the digital signal processor. At **325**, a signal is generated that represents the cable status (e.g., OK (no fault), short, open) based at least in part on the analysis.

At **310**, if a cable fault is found using the Time Domain Reflectometry test, then the method passes to **325** where a signal is generated representing the status. Hence, the second cable test may be by-passed and not performed.

In one embodiment, the analyzing at **320** may include analyzing the echo cancellation coefficients to determine a plurality of peaks from the reflected echo signals along the cable. For example, the plurality of peaks may include a near end peak that is a peak near a connection between the digital signal processor and the cable, and a tail end peak that is a peak some distance from the near end peak. An amplitude of the tail end peak may be determined and compared to a threshold(s). In another embodiment, the method may remove drifting for the tail end peak. The cable status is then determined based at least in part on the comparison result. The threshold(s) can be generated from observed cable characteristics and expected peak amplitudes associated with certain distances. For example observed results can be obtained from non defective cables that represent an expected tail end peak (second peak) at certain cable distances. If, from the echo coefficients, the second peak is found with a value that meets or exceeds a threshold associated with a distance from the near end, this condition may represent a cable fault. This will be described in more detail below.

With reference to FIG. **4**, techniques and algorithms for finding peaks from the echo coefficients are described. FIG. **4** illustrates an example diagram **400** that shows an example shape (represented by the dotted line) of coefficient values. As shown in FIG. **4**, well adapted echo coefficients should have two (2) peaks, named peak**1** (first peak) and peak**2** (second peak), that may occur over the cable **115**. Coefficients associated on the left side of the first peak (peak**1**) correspond to cable impedance near the link device **100**, which is the device performing the cable test. Finding the exact locations and peak values of the two peaks provide for more accurate detection of the impedance and location of cable faults along the cable **115**. As the second peak (peak**2**) is more attenuated by the cable **115**, the second peak is more difficult to be correctly detected.

Algorithms for Finding the First Peak (Peak**1**)

In one embodiment, the echo coefficients are analyzed to identify the first peak (peak**1**) from the head side to the tail side of the cable **115**. The echo canceller **150** (shown in FIG. **1**) stores the echo cancellation coefficients **155** according to distance from the head side. For example, if there are 100 taps (0-99) that store coefficients, tap 0 is the echo coefficient nearest to the head side along the cable and tap 99 is associated with the furthest distance from the head side. An echo coefficient that may qualify as the first peak (peak**1**) should meet the following conditions: (1) the first peak is located between a certain range of coefficient locations (e.g., closer to the head side); (2) the first peak is a peak (e.g., neighbor coefficients either have different signs or amplitudes are smaller); and (3) (a) an amplitude of the first peak should also be larger than a certain predetermined threshold (e.g., to eliminate small peaks), or (b) the relative amplitude of the first peak to the previous coefficient is larger than a threshold. The amplitude is evaluated using the absolute value of the coefficient. Finding peak values may include comparing neighboring echo coefficient values to identify high points, low points, and transition points (e.g., turning points: going from increasing values to decreasing values or vice versa).

Detection of the Second Peak (Peak**2**)

In one embodiment, the echo coefficients are analyzed to identify the second peak (peak**2**). The process searches for the second peak (peak**2**) from the tail side to the head side. The echo coefficients are analyzed to find peak values of reflections and their distance, which will determine whether a cable fault exists or not. The second peak (peak**2**) is divided into two possible types: type I is a flat peak (e.g., a smooth, more rounded transition at peak like a hill shape) and type II is sharp peak (e.g., point-like shape at peak). The second peak (peak**2**) is considered to be found if either type is detected.

In one embodiment, finding a type I peak (flat) includes finding the echo coefficient that matches the following conditions: (1) it is a peak; (2) its height should be larger than a certain predefined threshold; (3) its height should be bigger than another threshold determined by the biggest differences between neighbor coefficients on its right side (toward the tail side); and (4) the echo coefficient should be a certain distance away from the head side. As stated previously, typical cable responses and characteristics may be predetermined from testing known cables. Based on these observations, the second peak (peak**2**) can be expected to have a certain amplitude and be between certain distances along the cable (measured by thresholds). Finding the second peak (peak**2**) outside the amplitude thresholds generates a cable fault signal.

In one embodiment, finding a type II peak (sharp) includes finding the echo coefficient that matches the following conditions: (1) it is a peak; (2) its width is less than a threshold; and (3) its height should also be larger than certain predetermined threshold (determined from observed tests).

The peak width may be counted as follows. From the tail side to the head side, all points where the coefficients increase/decrease direction change are defined as turning points. The tail is considered as a turning point. A turning point is used as a floor for the turning points on their left side to calculate the peak amplitude. The distance between the turning point and its floor is considered as the width of this peak. The signed amplitude difference between the turning point and its floor is taken as the height of the peak. After each turning point, a counter is used to count the distance from the tail side to the head side.

As shown in FIG. **4**, coefficients may increase or decrease to the same direction slowly (drifting) before a real peak starts. The following algorithm may be used for removing the drifting. After a turning point, the points are not considered as a floor until the following conditions are both broken: (1) neighbor coefficient difference is less than a threshold; and (2) sum of difference is also less than a threshold.

Determining a Condition of a Cable

With reference to FIG. **5**, once the peaks are found, the condition of the cable can be determined. For example, a cable fault location is calculated by multiplying a constant to the distance between the first peak (peak**1**) and the second peak (peak**2**). The amplitude of the second peak (peak**2**) is compared to predetermined thresholds to determine the cable status including open, OK, or short. The thresholds may vary according to the distance between peak **1** and peak **2** from the head side to the tail side. For example, FIG. **5** illustrates example threshold values for a cable open condition **500** and a cable short condition **505**. The thresholds represent amplitude thresholds associated with a fault condition at various distances from the head side to the tail side along the cable. The cable open thresholds **500** may be represented as positive values and the cable short thresholds **505** may be represented as negative values. TDR uses a similar approach, but the value to be compared is the impulse amplitude instead of echo canceller coefficients. In one embodiment, if an echo coefficient is found to meet or exceed the threshold **500** or **505**, a fault condition signal is generated.

A status of "open" is determined if the second peak (peak**2**) amplitude (at its associated distance from the head side) is larger than the positive threshold **500** at that distance. A status of "short" is determined if the second peak (peak**2**) amplitude is less than the negative threshold **505** at the corresponding distance. A status of "OK" (no fault, normal condition) is determined if the second peak (peak**2**) amplitude is between the positive and negative thresholds **500** and **505**.

With the described apparatus, methods, and equivalent embodiments, a cable fault may be detected by analyzing echo cancellation coefficients. This may provide a more accurate or more sensitive mechanism for detecting faults than using time domain reflectometry. Since the echo cancellation coefficients exist in the echo canceller, a cable test may be performed at any time without having to interrupt the communication link.

The following includes definitions of selected terms employed herein. The definitions include various examples and/or forms of components that fall within the scope of a term and that may be used for implementation. The examples are not intended to be limiting. Both singular and plural forms of terms may be within the definitions.

References to "one embodiment", "an embodiment", "one example", "an example", and so on, indicate that the embodiment(s) or example(s) so described may include a particular feature, structure, characteristic, property, element, or limitation, but that not every embodiment or example necessarily includes that particular feature, structure, characteristic, property, element or limitation. Furthermore, repeated use of the phrase "in one embodiment" does not necessarily refer to the same embodiment, though it may.

"Logic", as used herein, includes but is not limited to hardware, firmware, a non-transitory computer medium having executable instructions stored thereon, and/or combinations of each to perform a function(s) or an action(s), and/or to cause a function or action from another logic, method, and/or system. Logic may include a software controlled microprocessor, a discrete logic (e.g., ASIC), an analog circuit, a digital circuit, a programmed logic device, a memory device containing instructions, and so on. Logic may include one or more gates, combinations of gates, or other circuit components. Where multiple logics are described, it may be possible to incorporate the multiple logics into one physical logic. Similarly, where a single logic is described, it may be possible to distribute that single logic between multiple physical logics. One or more of the components and functions described herein may be implemented using one or more of the logic elements. Logic as described herein is limited to statutory subject matter under 35 U.S.C §101.

While for purposes of simplicity of explanation, illustrated methodologies are shown and described as a series of blocks. The methodologies are not limited by the order of the blocks as some blocks can occur in different orders and/or concurrently with other blocks from that shown and described. Moreover, less than all the illustrated blocks may be used to implement an example methodology. Blocks may be combined or separated into multiple components. Furthermore, additional and/or alternative methodologies can employ additional, not illustrated blocks. The methods described herein are limited to statutory subject matter under 35 U.S.C §101.

To the extent that the term "includes" or "including" is employed in the detailed description or the claims, it is intended to be inclusive in a manner similar to the term "comprising" as that term is interpreted when employed as a transitional word in a claim.

While example systems, methods, and so on have been illustrated by describing examples, and while the examples have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the systems, methods, and so on described herein. Therefore, the disclosure is not limited to the specific details, the representative apparatus, and illustrative examples shown and described. Thus, this disclosure is intended to embrace alterations, modifications, and variations that fall within the scope of the appended claims, which satisfy the statutory subject matter requirements under 35 U.S.C §101.

What is claimed is:

1. An apparatus, comprising:

a transmitter configured to transmit signals to a cable;

a receiver configured to receive signals from the cable;

an echo canceller connected to the transmitter and the receiver, wherein the echo canceller includes echo coefficients that are used to reduce echo signals from the signals received by the receiver; and

a cable tester configured to analyze the echo coefficients from the echo canceller to determine at least a tail end peak from values of the echo coefficients wherein the tail end peak is a peak value from the echo coefficients;

wherein the cable tester is configured to determine a status of the cable by comparing an amplitude of the echo coefficients at the tail end peak to a threshold.

2. The apparatus of claim **1**, wherein the cable tester is further configured to analyze the echo coefficients from the echo canceller to determine a near end peak that is a peak near a connection between the apparatus and the cable.

3. The apparatus of claim **1**, wherein the cable tester is further configured to determine the status of the cable by determining a distance of the tail end peak along the cable based at least on the peak value from the echo coefficients and comparing the distance of the tail end peak to a distance threshold.

4. The apparatus of claim **1**, wherein the echo canceller comprises a plurality of taps, wherein each tap stores a corresponding echo coefficient associated with an echo signal from a location along the cable, wherein the echo signal is received from the cable by the receiver in response to the transmitter having transmitted a signal to the cable.

5. The apparatus of claim **4**, wherein the echo canceller comprises a filter adapter that modifies the echo coefficients in the plurality of taps based at least in part on error signals determined from cancelling echo signals.

6. The apparatus of claim **1**, wherein the apparatus is a physical layer device.

7. The apparatus of claim **1**, wherein the apparatus further comprises:

a time domain reflectometry (TDR) cable tester configured to transmit a test pulse through the cable and determine a status of the cable from received reflected signals; and

wherein the apparatus is configured to perform a first cable test using the TDR cable tester, and if a fault in the cable is not found by the TDR cable tester, then the apparatus is configured to perform a second cable test by analyzing the echo coefficients with the cable tester.

8. A method implemented by a communication device including at least an electronic circuit, the method comprising:

accessing, by at least the electronic circuit, echo cancellation coefficients from a memory;

analyzing, by at least the electronic circuit, the echo cancellation coefficients to determine a status of a cable operatively connected to the communication device, wherein the analyzing includes determining at least a tail end peak that is a peak value from values of the echo coefficients in the memory;

determining, by at least the electronic circuit, an amplitude of the tail end peak and comparing the amplitude to a threshold, wherein the status of the cable is determined based at least in part on the comparison; and

generating, by at least the electronic circuit, a signal that represents the status of the cable.

9. The method of claim **8**, further comprising analyzing the echo cancellation coefficients to determine a near end peak that is a peak near a connection between the communication device and the cable.

10. The method of claim **8**, further comprising determining the status of the cable by determining a distance of the tail end peak along the cable based at least on the peak value from the echo coefficients and comparing the distance of the tail end peak to a distance threshold.

11. The method of claim **8**, wherein the analyzing determines the status of the cable to be a normal condition, a short condition, or an open condition.

12. The method of claim **8**, wherein accessing the echo cancellation coefficients includes processing the echo cancellation coefficients from a plurality of taps from an echo cancellation circuit.

13. The method of claim **8**, wherein the status of the cable is determined based at least in part on the amplitude of the tail end peak relative to the threshold and a distance of the tail end peak from a near end peak along the cable.

14. The method of claim **13**, wherein determining the status of the cable includes comparing the distance of the tail end peak from the near end peak to a distance threshold associated with a fault condition.

15. The method of claim **8**, further comprising prior to performing the accessing and the analyzing:

transmitting a test pulse on the cable and receiving a reflection signal;

detecting whether a fault in the cable is present by processing the reflection signal using time domain reflectometry; and

if the fault in the cable is not detected, then performing the accessing and analyzing of the echo cancellation coefficients to determine the status of the cable.

16. An apparatus comprising:

a transmitter for transmitting signals to a cable;

a receiver for receiving signals from the cable;

an echo cancellation circuit configured to determine echo cancellation coefficients that model an impulse response of interference signals received by the receiver from the cable; and

a cable tester configured to determine a fault in the cable based on the echo cancellation coefficients of the echo cancellation circuit;

a time domain reflectometry (TDR) cable tester configured to transmit a test pulse though the cable and determine a status of the cable from received reflected signals based on at least time domain reflectometry; and

wherein the apparatus is configured to perform a first cable test using the TDR cable tester to determine the status of the cable, and if a fault in the cable is not found, then perform a second cable test by analyzing the echo cancellation coefficients with the cable tester to determine the status of the cable.

17. The apparatus of claim **16**, wherein the cable tester is configured to determine whether the fault exists in the cable based at least in part on the echo cancellation coefficients, wherein the cable tester is configured to analyze the echo cancellation coefficients from the echo cancellation circuit to determine a peak coefficient value from values of the echo coefficients, wherein the peak coefficient value is associated with a location along the cable and a distance along the cable, and compare the distance of the peak coefficient value to a distance threshold.

18. The apparatus of claim **16**, wherein the cable tester is configured to determine a plurality of peak values from values of the echo cancellation coefficients, wherein the plurality of peak values include (i) a near end peak that is a peak near a connection between the transmitter and the cable, and (ii) a tail end peak that is a peak found at a distance along the cable from the near end peak.

19. The apparatus of claim **16**, wherein the cable tester is configured to determine the status of the cable by (i) comparing an amplitude of a tail end peak to a threshold, wherein the tail end peak is a peak coefficient value found from the echo cancellation coefficients, wherein the peak coefficient value is associated with a location along the cable which is used to determine a distance along the cable, and (ii) comparing the distance to a distance threshold;

wherein the status of the cable includes a normal status, a short status, or an open status.

20. The apparatus of claim **16**, wherein the cable tester is configured to determine a signal peak of the interference signals from the echo cancellation coefficients, and wherein the fault in the cable is determined based at least in part on an amplitude of the signal peak compared to an amplitude threshold value.

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